

## Tips and tricks for improving quality, scalability in RF/microwave assemblies

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The best thing that can happen for any RF/microwave designer is for a customer to initially order up a small batch of your parts and then circle back with a really big order. Right?

Well, it's a good thing if you actually planned ahead for higher-volume manufacturing and designed a module that's able to leverage automated assembly processes. If not, you could be in for a world of hurt. The good news is that you can set yourself up for success if you factor automation considerations into your device design up front.

First, let's take a look at the benefits of automation, and why you may want to plan for it regardless of whether you anticipate larger volume manufacturing or not.

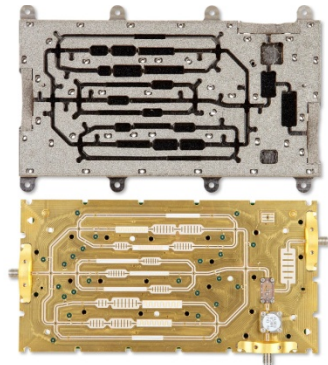
One of the most important benefits of automated assembly is improved accuracy and repeatability. As RF modules and integrated microwave assemblies (IMAs) become more complex due to added functionality, automated assembly is a good way to eliminate variations in component placement and/or bond profiles. The more variability there is, the more the performance is likely to suffer and the harder it will be to isolate and address problems. Automated assembly not only helps ensure that every device is built consistently but also enables easier modifications to the assembly process via equipment reprogramming to eliminate problems.



This isn't to say a skilled technician or quality manual assembly house can't get small batches right, but this approach lacks any real ability to scale with increasing demand. If the call does come for increased volume, it's easier to ramp up production on RF modules and IMAs that have been designed for automation up front. While there will most likely still be some manual work involved, automation dramatically improves productivity per operator. It also provides the flexibility to improve process flows needed to meet demand, or to line up a second manufacturer to reduce risk and ensure supply.

Now that you have a firm grasp of the advantages of automated assembly, here are four automation considerations that should be factored into product development.

1. **Respect Tolerances** – Understand the tolerances for the equipment you have available, or that of your external manufacturing house, and then design within the capabilities of the machine. Every piece of equipment has limitations and constraints; exceeding those limits can limit your options.
2. **Include visual references** –All automated equipment needs to visually reference the part in order to align itself. In some cases, machines can use edges or mounting points as references, but accuracy improves considerably if you include fiducial points in strategic locations. While manual operators can get by without fiducials, machines cannot.
3. **Remove obstructions** – Unlike general purpose circuit boards, high-end RF and microwave assemblies often require isolation cavities that can get in the way of automated pick and place equipment. Instead of building cavities into the RF or microwave housing itself, you could try designing the cavities into the lid. In many cases, this approach can provide adequate performance while greatly expanding assembly options. See the example of a cavitized lid and corresponding board below.



4. **Component selection** – Different components often have different assembly requirements. Make sure you select components that can be machine installed, or at least keep the conical-shaped inductors, for instance, to a minimum.

Automated assembly of high-complexity RF and microwave devices can provide significant advantages in scalability and repeatability. However, to exploit these advantages, automation must be factored into the design phase. Whether you have manufacturing capabilities in house or you will be working with an external resource, it pays to plan out your assembly and automation strategies sooner rather than later. Next up, we'll take a look at some strategies for development and rapid prototyping.

For more information, or to discuss your RF / Microwave component needs, contact Tektronix Component Solutions at:

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